CORROSION OF METAL PARTICLE AND METAL EVAPORATED TAPES

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Very high coercivity metal particle (MP) and metal evaporated (ME) tapes are being used in 8mm video and digital audio tape applications, and more recently in digital data recording applications. In view of the inherent susceptibility of such media to environmental corrosion, a number of recent studies have addressed their long term stability and archivability. These studies[1-4] have used an accelerated corrosion test based either on elevated temperature-humidity or polluting gas atmospheres known as Battelle tests. A comparison of the Battelle test results performed at different Laboratories reveals a large variation from one location to another[4], presumably due to incorrect replication of the Battelle condition. Furthermore, when the Battelle tests are performed on enclosed cartridges, it is quite possible that diffusion limits the penetration of the extremely low concentration polluting gaseous species to the inner layers of the tapes during the short time of the accelerated test(typically 7 to 10 days), whereas in real life these diffusion limitations may not apply. To avoid this uncertainty ,in this study we investigated the corrosion behavior of commercial 8mm MP and ME tapes when cassettes without their external plastic cases were exposed to 50°C and 80% RH for 7.5 weeks.

The effects of the corrosion were studied by measuring the error statistics at a density of 53.3kfci (2100 fc/mm) using an 8mm helical scan recorder with 0.25 micron gap MIG heads controlled by a Media Logic 4500 Digital Tape Evaluator System. This system is programmed to measure the dropouts at different threshold levels and to provide error maps for large numbers of tracks. The error statistic were measured before and after the corrosion cycle, and were compared on the basis of the change in the average number of errors per track and the error size distribution at a specific threshold level, as well as complete error maps and counts for a large number of tracks.

Our results show a large increase in errors due to corrosion for all the MP and Me tapes studies (typically by two orders of magnitude). There is also a large variation in corrosion stability among the tapes from different manufacturers. Typical results for MP and ME tapes are shown in the figures below. This large increase in errors may be due to a change in the magnetization of the tapes (particularly in the critical 0.3 micron region near the surface of the tapes which represents the area responsible for most of the signal at the 53.3 kfci recording density), or to a change in the surface morphology of the tapes, or a combination thereof.

1. E. F. Wollack et al, paper JA-3 in the Abstracts of the Intermag Conference, Washington, D.C., March 1989.
2. D. E. Speliotis, IEEE Trans. Magn., MAG-26, 124 (1990).
3. Y. Yamamoto et al, IEEE Trans. Magn., MAG-26, 2098 (1990).
4. A. Djalali et al, Proc. 1st Intl. Symposium on Corrosion of Electronic Materials and Devices, Electrochem. Soc. p.430 (1991)

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout vs. Threshold (20/28/80)

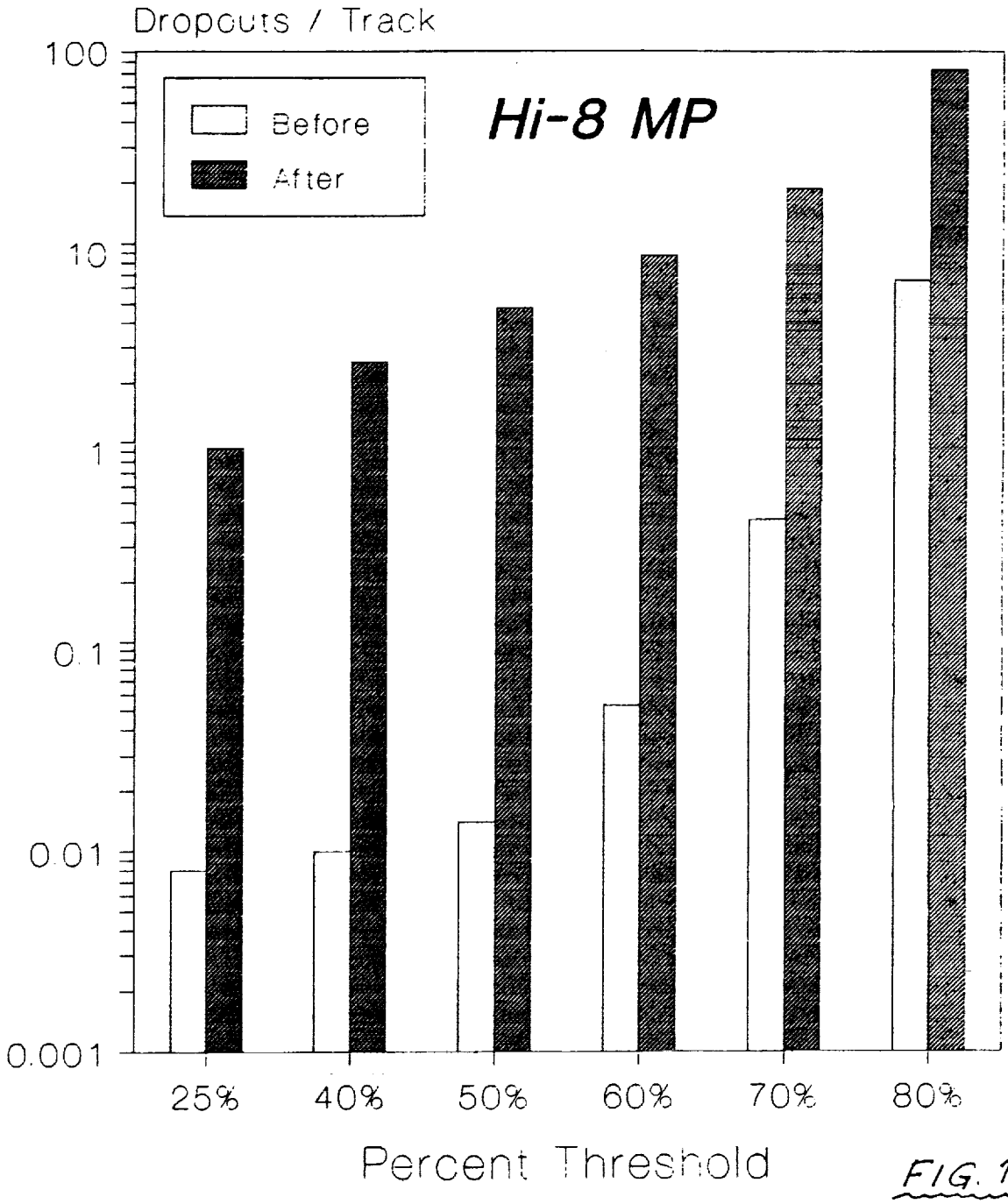


FIG. 1
Hi 8 MP Tape before and after corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout Size Distibution (75% TH., 28G)

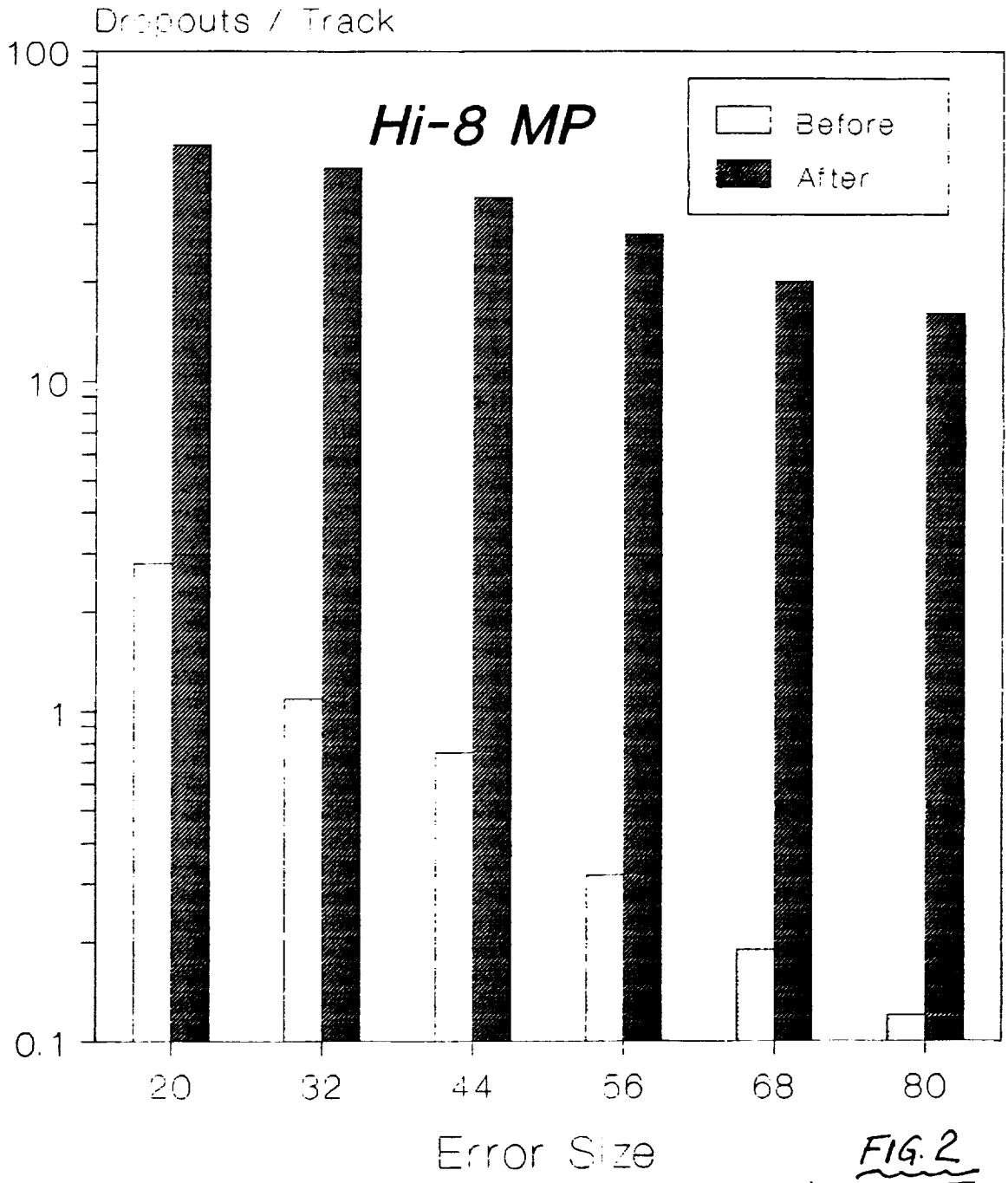


FIG. 2
Hi 8MP Tape
before and after
Corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout vs. Threshold (20/28/80)

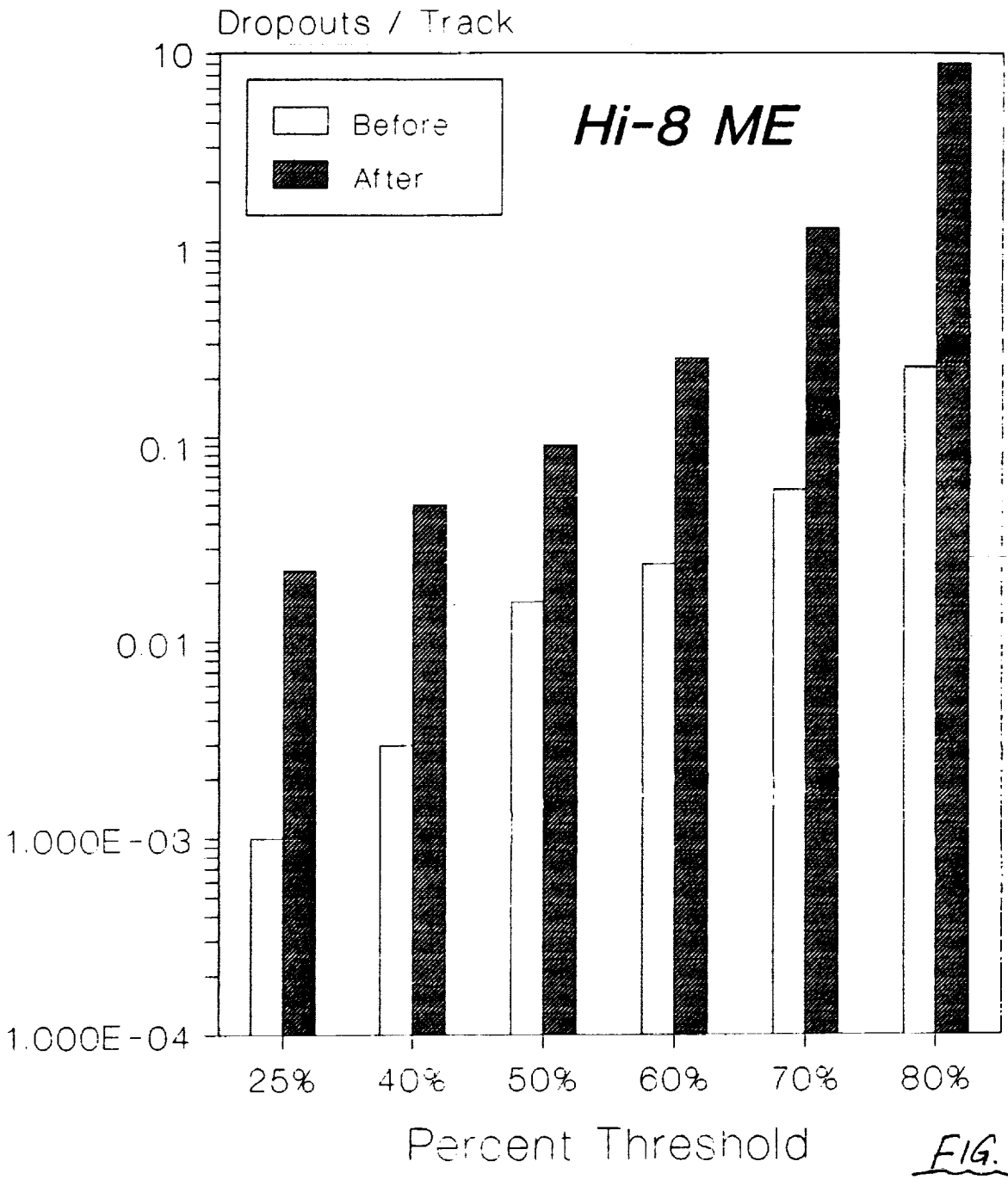


FIG. 3
Hi8ME Tape before and after corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout Size Distibution (75% TH., 28G)

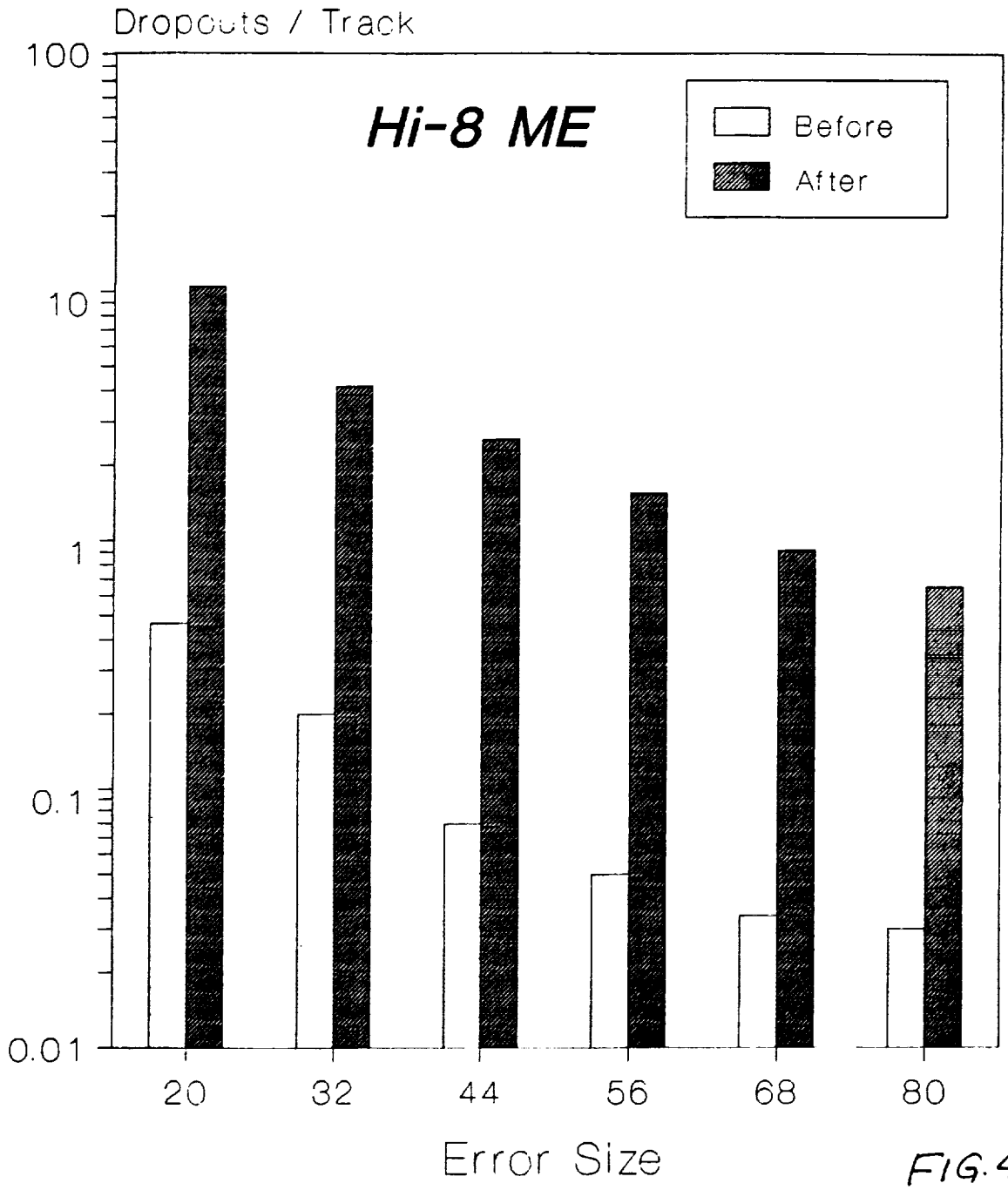


FIG. 4
Hi8 ME Tape
before and after
Corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout vs. Threshold (20/28/80)

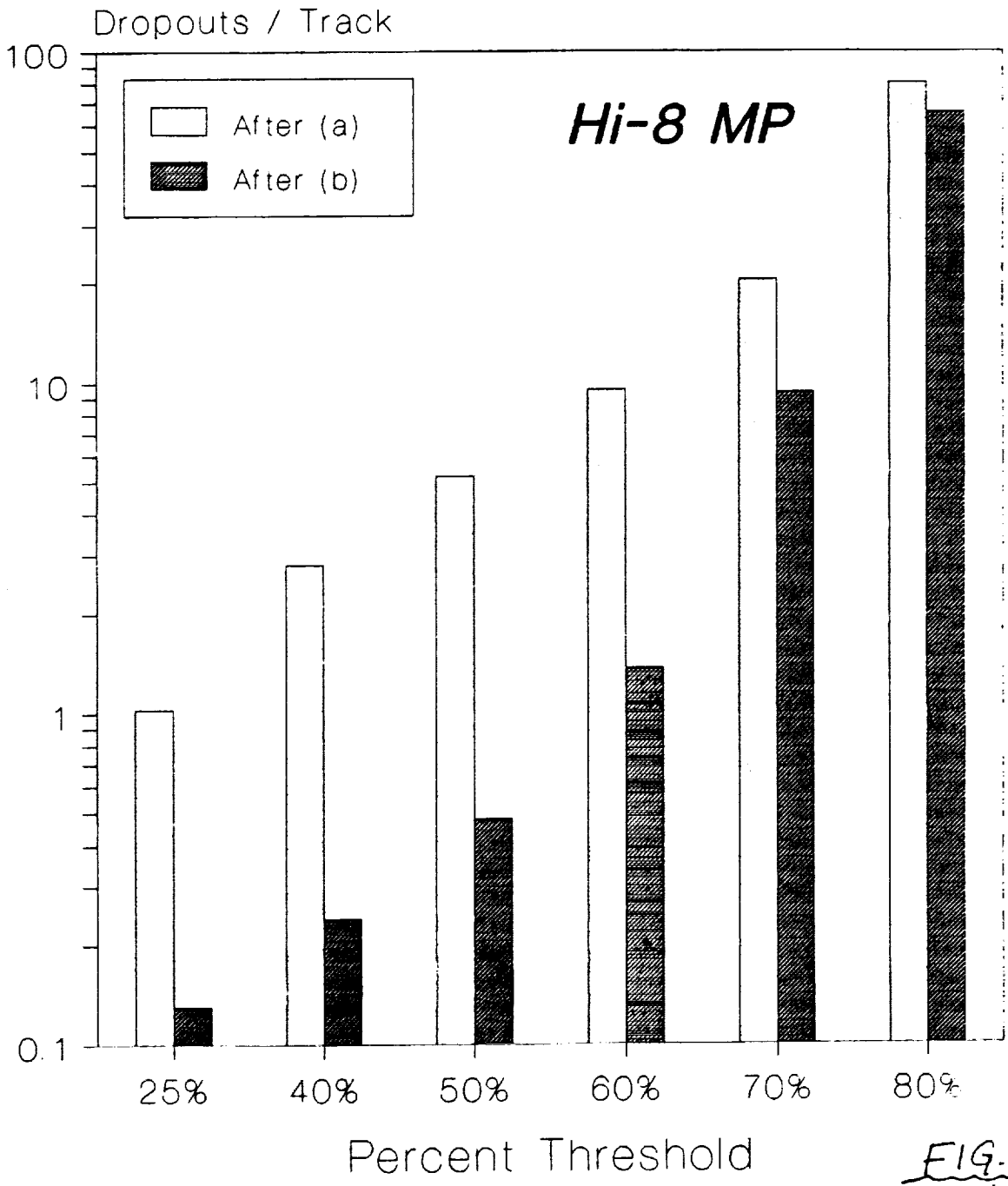


FIG. 5
Two different Hi 8 MP Tapes after corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout Size Distibution (75% TH., 28G)

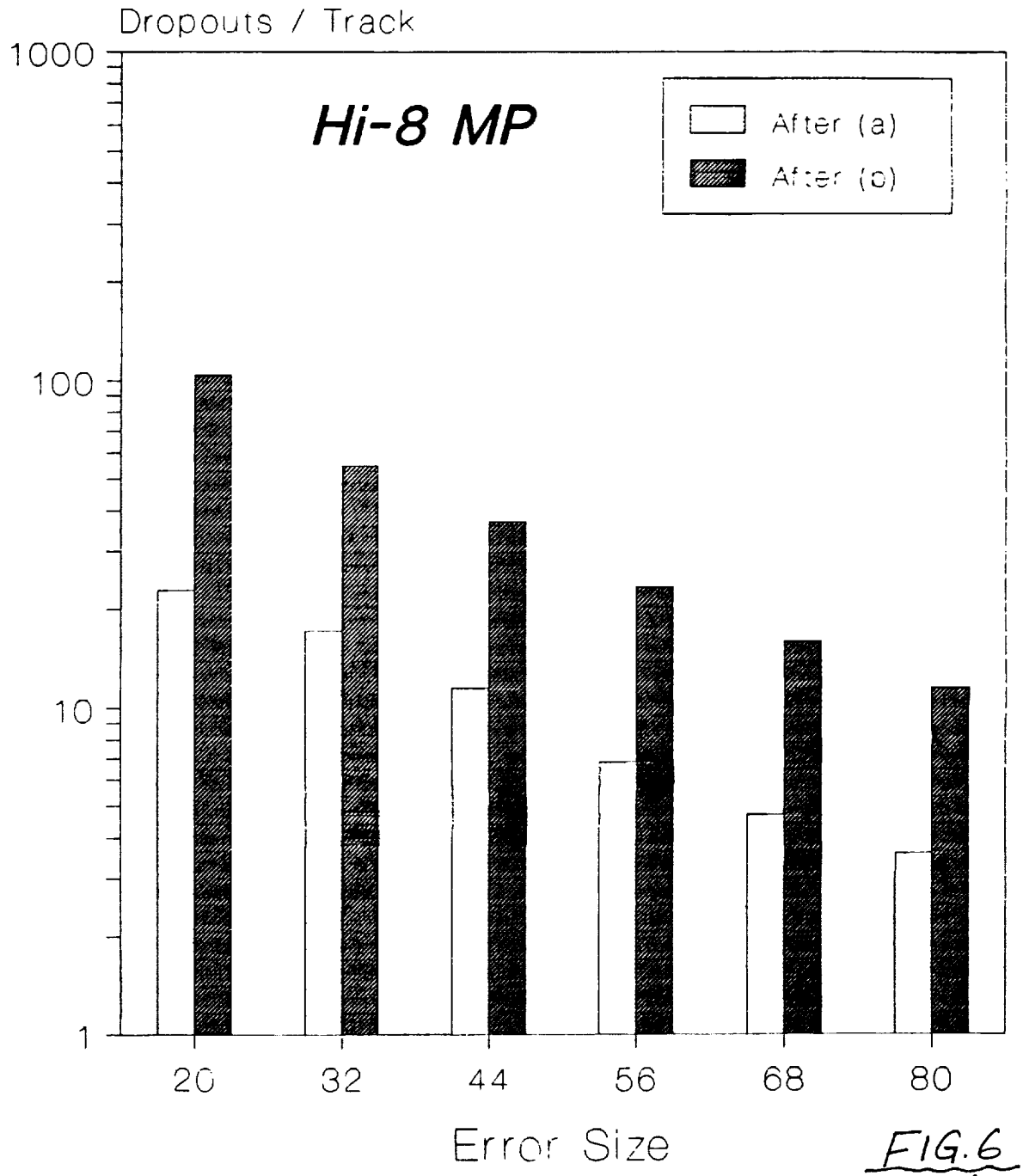


FIG. 6
Two different Hi8MP Tapes after corrosion

C-3

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout vs. Threshold (20/28/80)

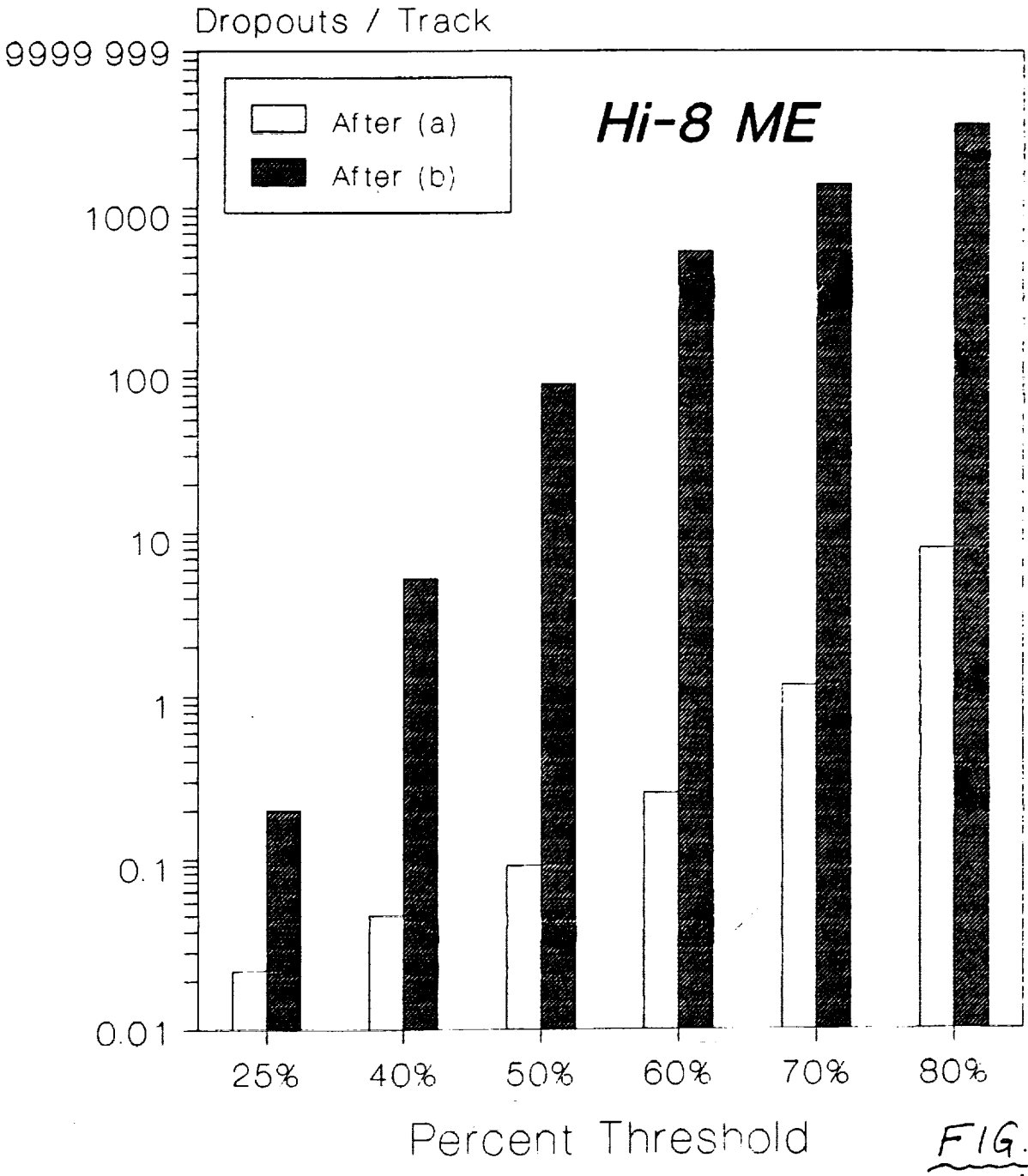


FIG. 7
Two different Hi8ME Tapes after Corrosion

Corrosion Test: 7.5 Weeks 50C, 80% RH
Dropout Size Distibution (75% TH., 28G)

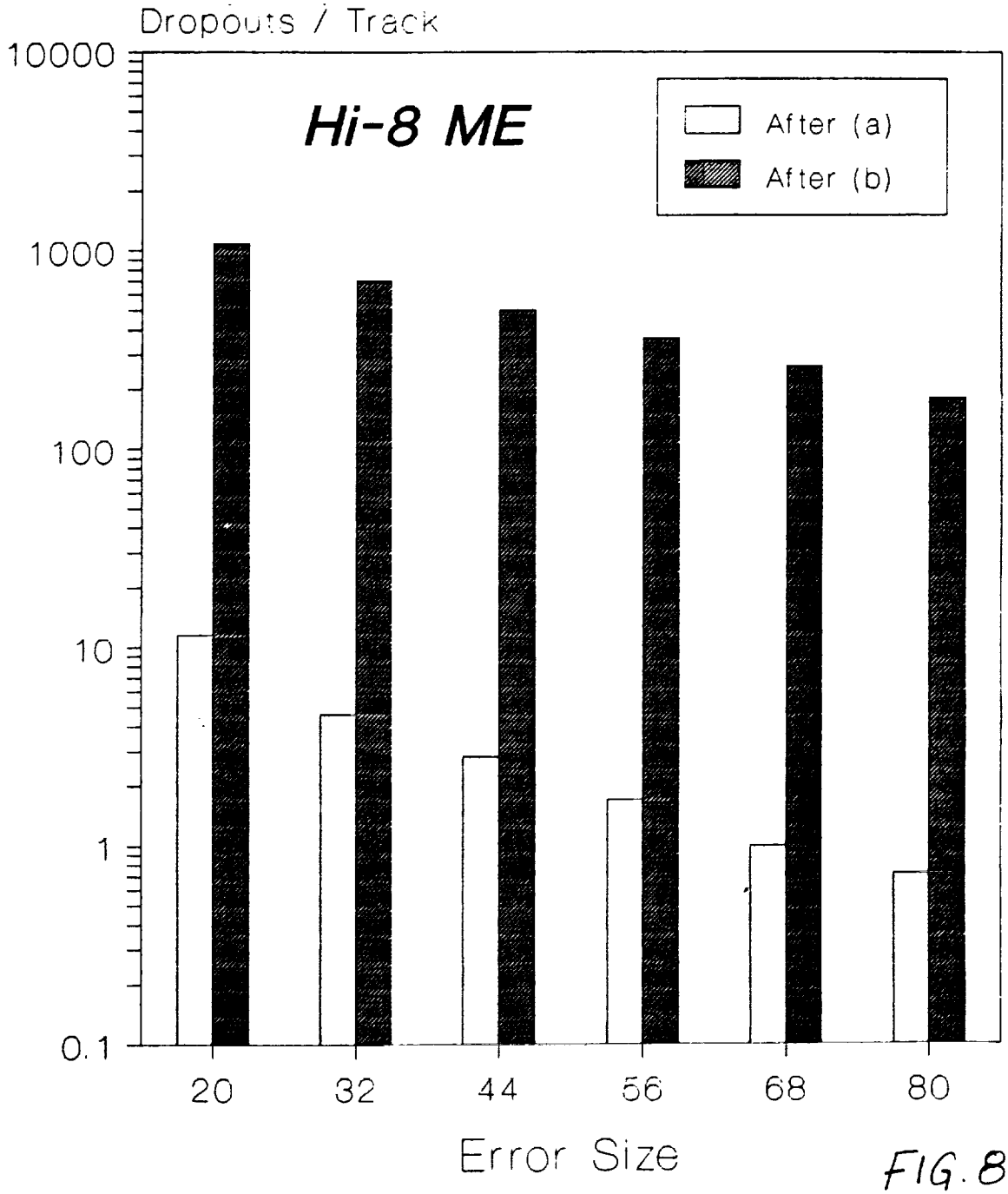
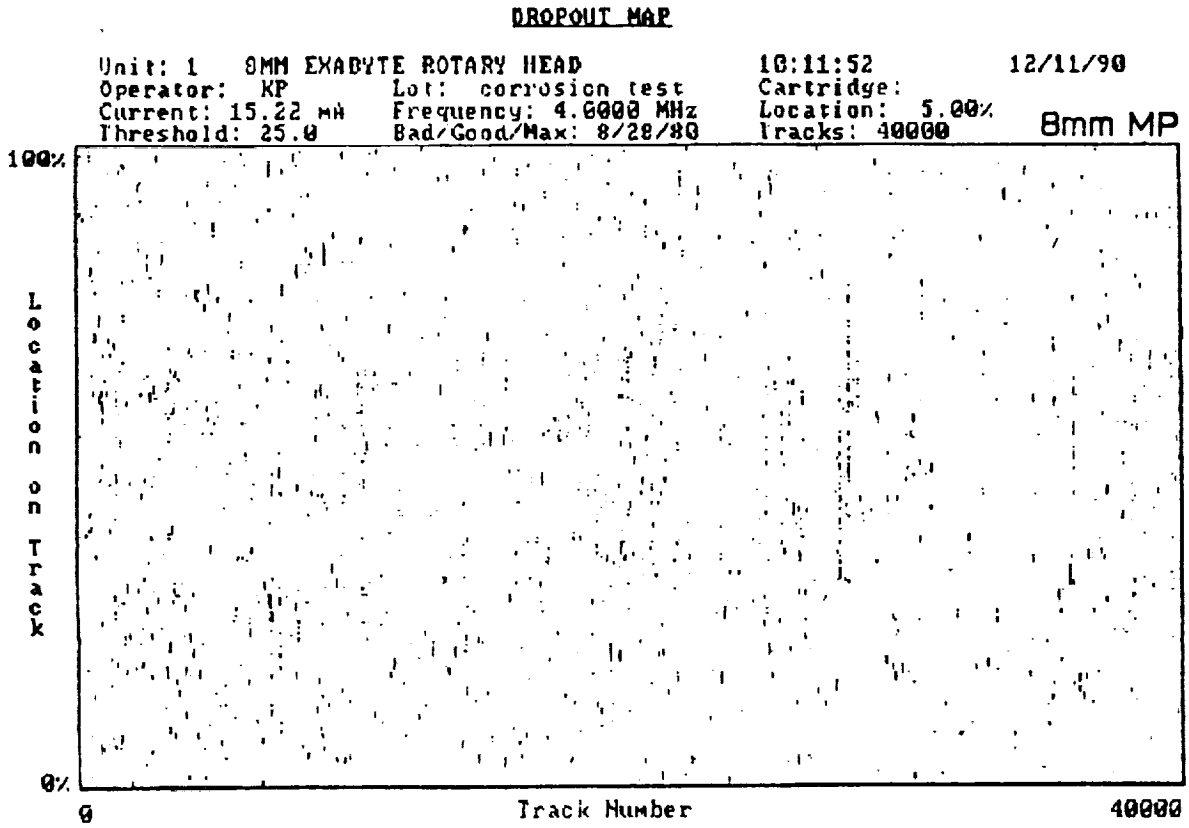
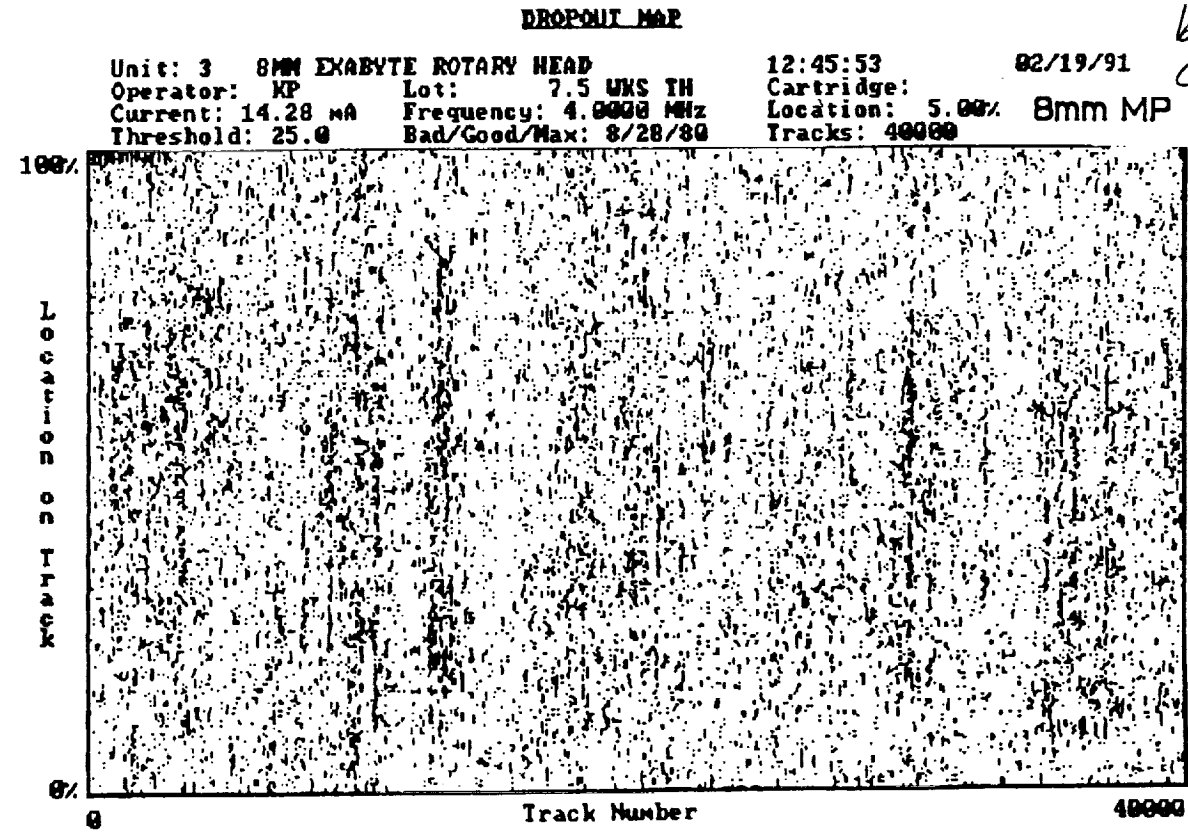


FIG. 8
Two different Hi8ME Tapes after Corrosion



Before

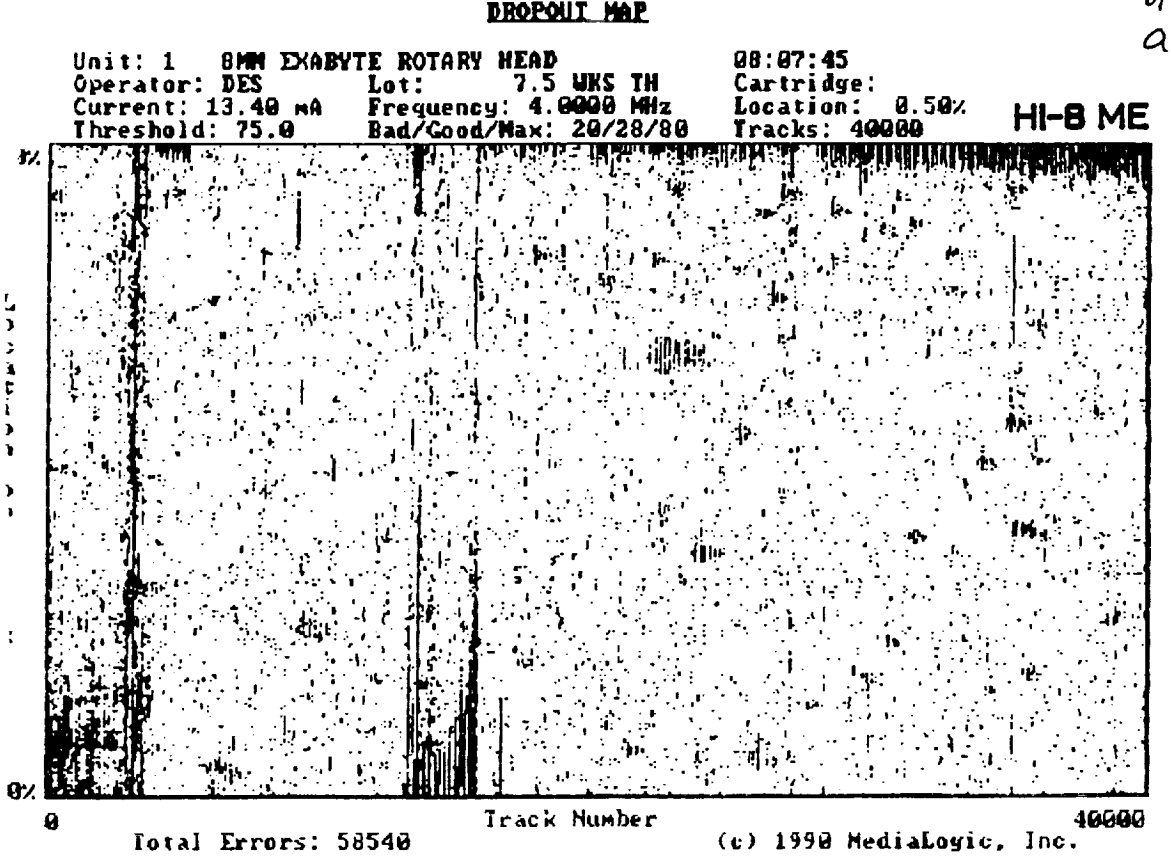
FIG. 9
Error maps of 8mm MP Tape before and after corrosion



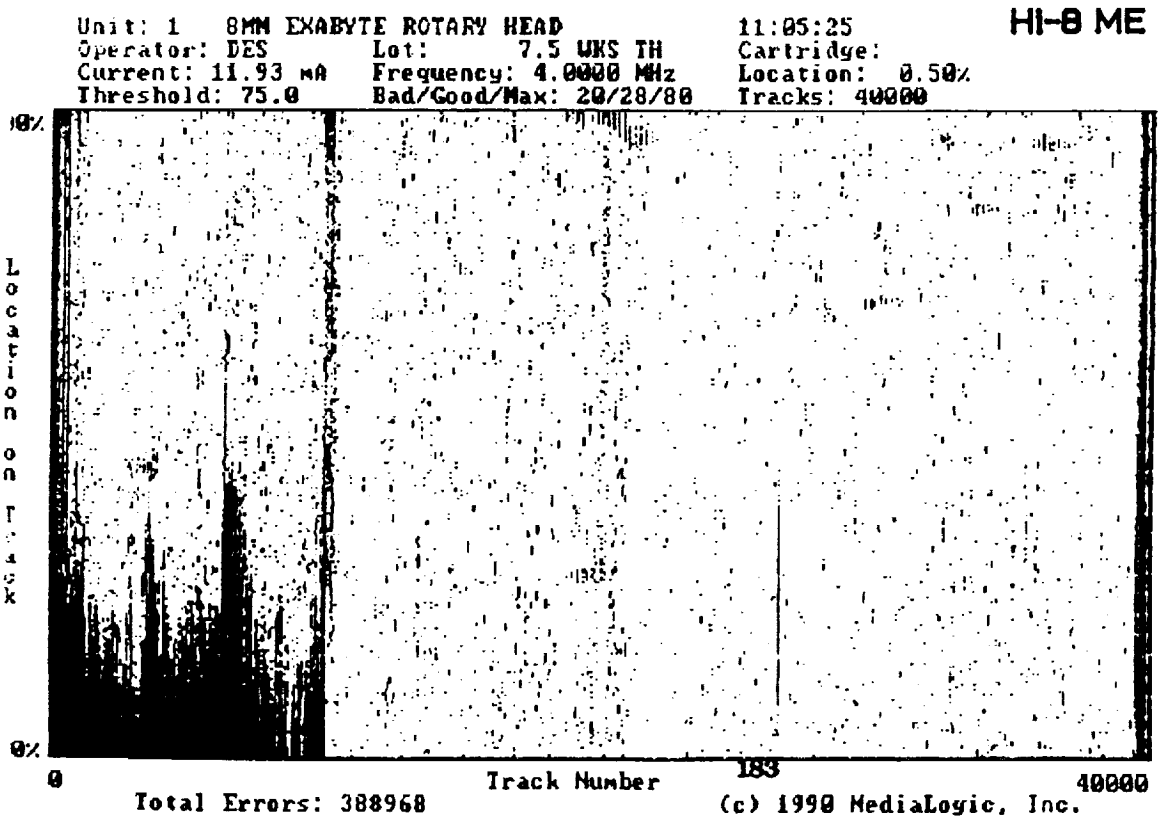
After

FIG.10

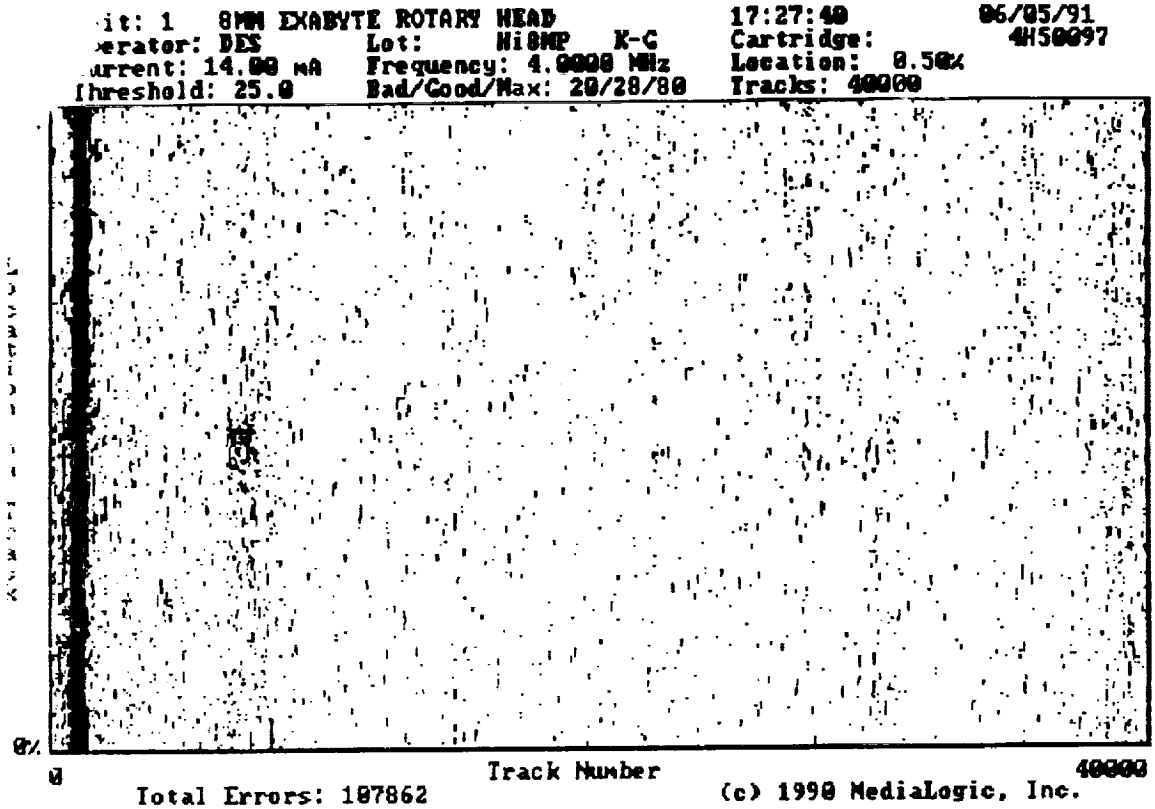
Error maps of two different Hi8ME tapes after corrosion



After (a)



After (b)



DROPOUT MAP

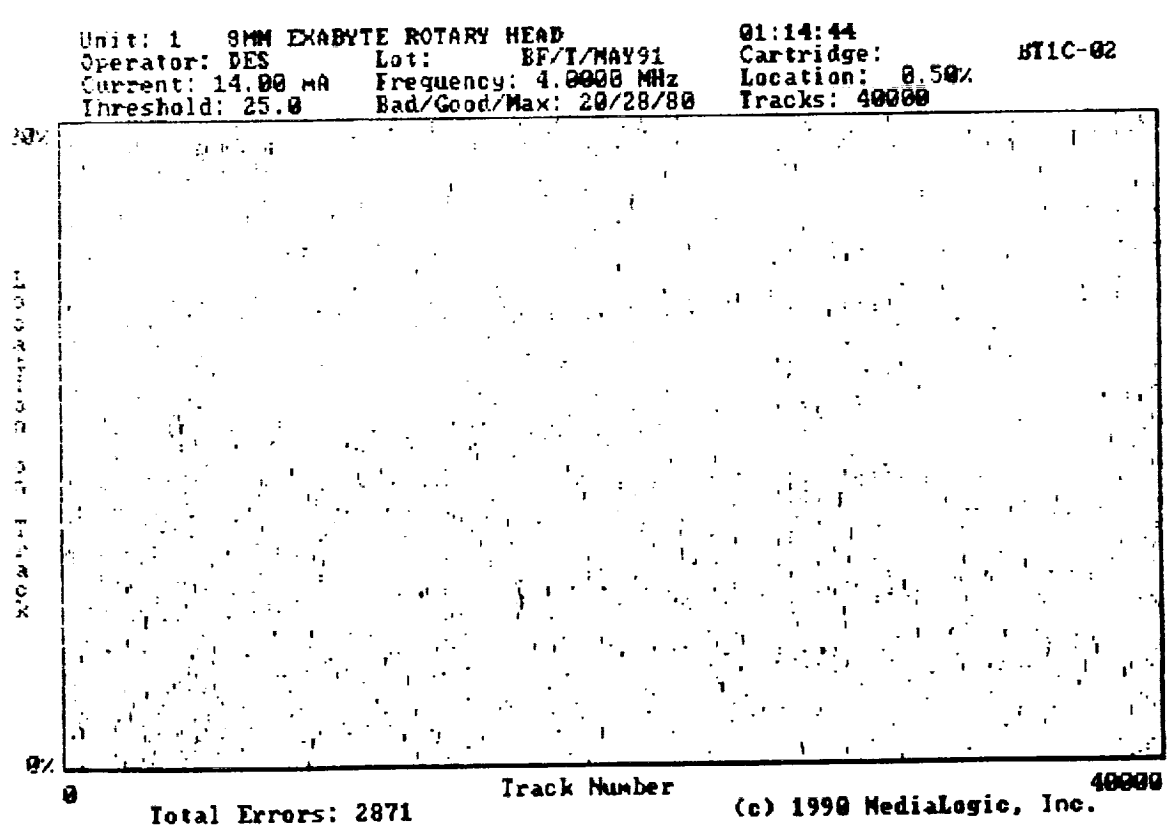
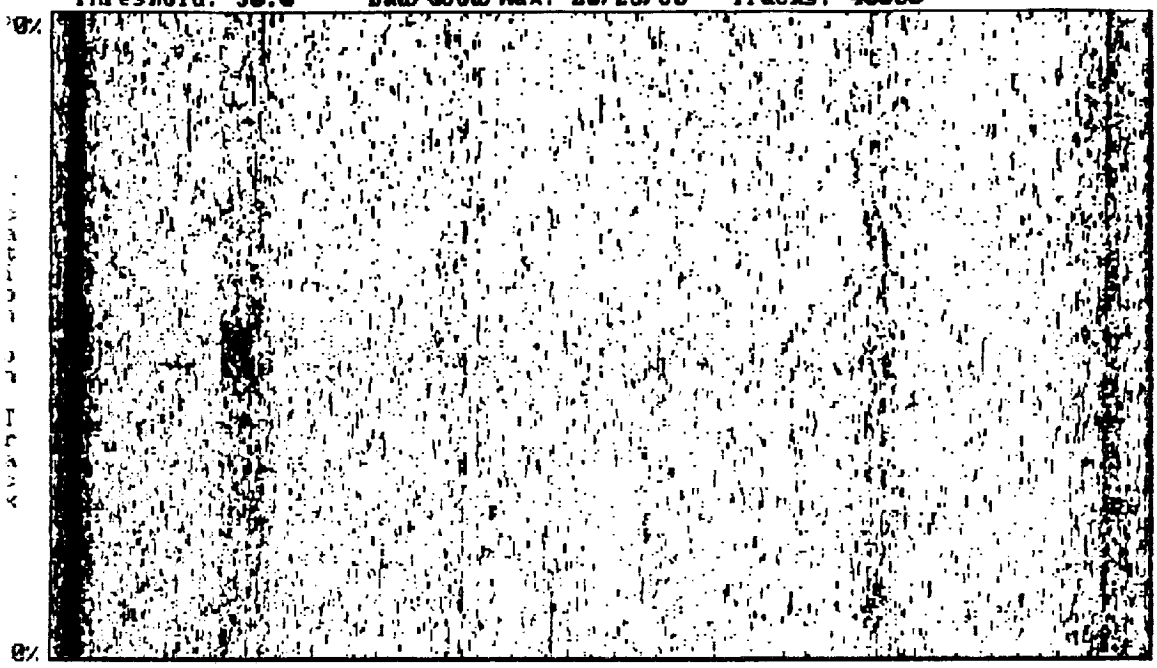


FIG. 11
Error maps of Hi8MP and Ba Tapes after 1 mi testing.

DROPOUT MAP

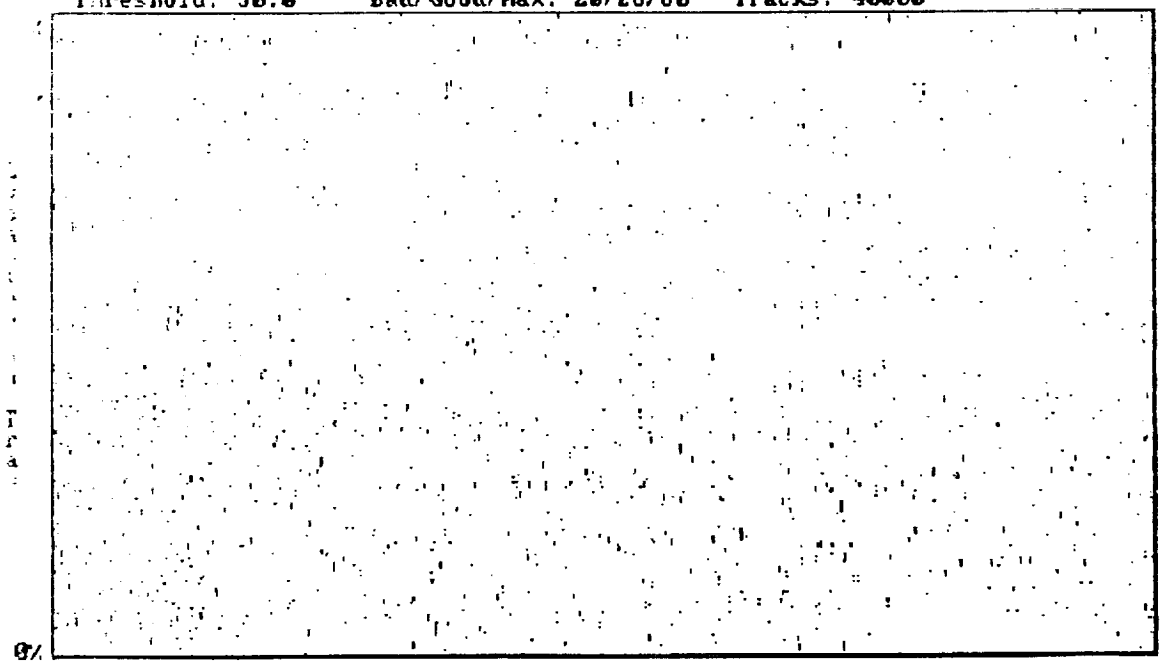
Unit: 1 8MM EXABYTE ROTARY HEAD 16:58:41 06/05/91
Operator: DES Lot: Hi8MP K-G Cartridge: 4H50097
Current: 14.00 mA Frequency: 4.0000 MHz Location: 0.50%
Threshold: 50.0 Bad/Good/Max: 20/28/80 Tracks: 40000



Total Errors: 236298 (c) 1990 MediaLogic, Inc.

DROPOUT MAP

Unit: 1 8MM EXABYTE ROTARY HEAD 16:15:47 06/05/91
Operator: DES Lot: BF/I/MAY91 Cartridge: BTIC-02
Current: 14.00 mA Frequency: 4.0000 MHz Location: 0.50%
Threshold: 50.0 Bad/Good/Max: 20/28/80 Tracks: 40000



Total Errors: 3154 (c) 1990 MediaLogic, Inc.

FIG. 12
Error maps of Hi8MP and Ba/Fe Tapes after 1 mon testing.